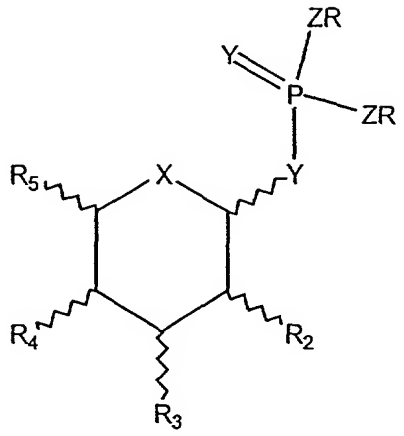
We claim:

1. A compound represented by generalized structure **1**:



1

wherein

X represents O, NR', or S;

Y represents independently for each occurrence O, NR', or S;

Z represents independently for each occurrence O, NR', or S;

R is selected, independently for each occurrence, from the group consisting of H, alkyl, heteroalkyl, aryl, aralkyl, heteroaryl, and heteroaralkyl;

R' is selected, independently for each occurrence, from the group consisting of H, alkyl, heteroalkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, acyl, and sulfonyl;

R_2, R_3, and R_4 are independently selected from the group consisting of R, -OR', -SR', -NR'$_2$, -OSO_3H, -OPO_3H_2;

R_5 is selected from the group consisting of R, -$(CR_2)_nOR'$, -$(CR_2)_nSR'$, and -$(CR_2)_nNR'_2$; and

n is an integer selected from the range 0 to 10 inclusive.

2. The compound of claim 1, wherein X represents O or NR'.

3. The compound of claim 1, wherein X represents O.

4. The compound of claim 1, wherein Y represents O.

5. The compound of claim 1, wherein Y represents S.

6. The compound of claim 1, wherein Z represents O.

7. The compound of claim 1, wherein Z represents S.

8. The compound of claim 1, wherein X represents O or NR'; and Y represents O.

9. The compound of claim 1, wherein X represents O or NR'; and Y represents S.

10. The compound of claim 1, wherein X represents O or NR'; and Z represents O.

11. The compound of claim 1, wherein X represents O or NR'; and Z represents S.

12. The compound of claim 1, wherein X represents O; and Y represents O.

13. The compound of claim 1, wherein X represents O; and Y represents S.

14. The compound of claim 1, wherein X represents O; and Z represents O.

15. The compound of claim 1, wherein X represents O; and Z represents S.

16. The compound of claim 1, wherein X represents O; Y represents O or S; and Z represents O or S.

17. The compound of claim 1, wherein X represents O; Y represents O; and Z represents O or S.

18. The compound of claim 1, wherein X represents O; Y represents S; and Z represents O or S.

19. The compound of claim 1, wherein X represents O; Y represents O; and Z represents O.

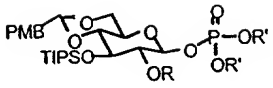
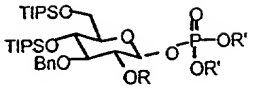
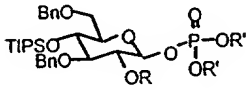
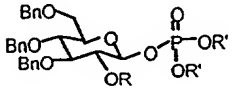
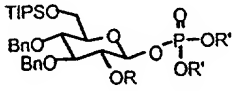
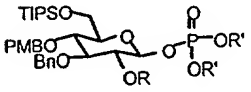
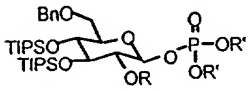
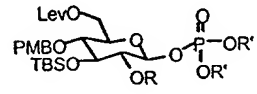
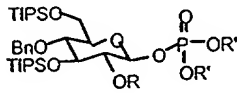
20. The compound of claim 1, wherein X represents O; Y represents O; and Z represents S.

21. The compound of claim 1, wherein X represents O; Y represents S; and Z represents O.

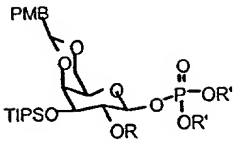
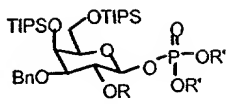
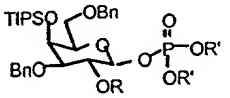
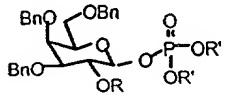
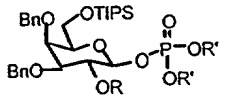
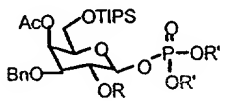
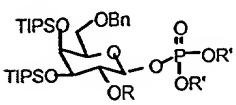
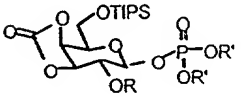
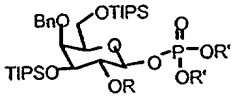
22. The compound of claim 1, wherein X represents O; Y represents S; and Z represents S.

23. The compound of claim 1, wherein said compound is represented by one of the following structures:

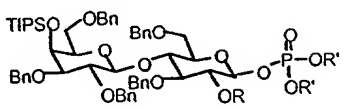
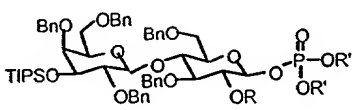
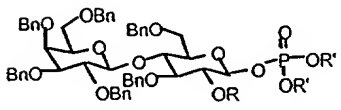
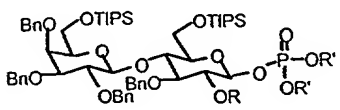
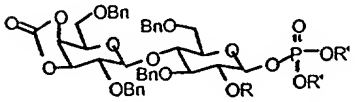
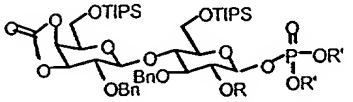
Glucose

Galactose

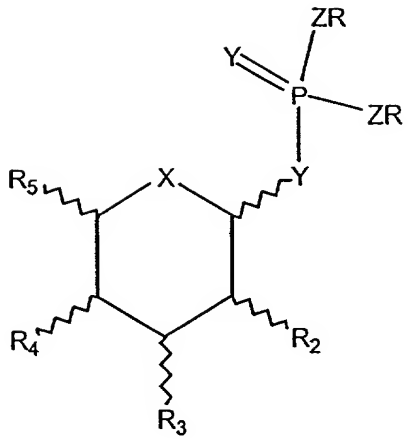










Lactose

24. A method of glycosylating a substrate, comprising the step of:

combining **1** with a substrate comprising an -OH, -NH-, or –SH moiety under reaction conditions whereby said moiety of said substrate reacts with **1** to produce a glycosylated substrate, wherein **1** is represented by the following structure:



1

wherein

X represents O, NR', or S;

Y represents independently for each occurrence O, NR', or S;

Z represents independently for each occurrence O, NR', or S;

R is selected, independently for each occurrence, from the group consisting of H, alkyl, heteroalkyl, aryl, aralkyl, heteroaryl, and heteroaralkyl;

R' is selected, independently for each occurrence, from the group consisting of H, alkyl, heteroalkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, acyl, and sulfonyl;

R_2, R_3, and R_4 are independently selected from the group consisting of R, -OR', -SR', -NR'$_2$, -OSO_3H, -OPO_3H_2;

R_5 is selected from the group consisting of R, -$(CR_2)_nOR'$, -$(CR_2)_nSR'$, and -$(CR_2)_nNR'_2$; and

n is an integer selected from the range 0 to 10 inclusive.

25. The method claim 24, further comprising the step of:

purifying said glycosylated substrate.

26. The method of claim 24 or 25, further comprising the step of:

combining said glycosylated substrate with **1** under reaction conditions whereby an -OH, -NH-, or –SH moiety of said glycosylated substrate reacts with **1** to produce a glycosylated substrate comprising at least two sugar moieties derived from compounds represented by **1**.

27. The method of claim 24 or 25, wherein said reaction conditions comprise a Lewis acid.

28. The method of claim 26, wherein said reaction conditions comprise a Lewis acid.

29. The method of claim 24 or 25, wherein said reaction conditions comprise a silyl sulfonate.

30. The method of claim 26, wherein said reaction conditions comprise a silyl sulfonate.

31. The method of claim 24 or 25, wherein said reaction conditions comprise a silyl triflate.

32. The method of claim 26, wherein said reaction conditions comprise a silyl triflate.

33. The method of claim 24 or 25, wherein said reaction conditions comprise a trialkylsilyl triflate.

34. The method of claim 26, wherein said reaction conditions comprise a trialkylsilyl triflate.

35. The method of claim 24 or 25, wherein said reaction conditions comprise trimethylsilyl triflate.

36. The method of claim 26, wherein said reaction conditions comprise trimethylsilyl triflate.

37. The method of claim 24 or 25, wherein said glycosylated product is produced in greater than about 50% yield based on **1**.

38. The method of claim 24 or 25, wherein said glycosylated product is produced in greater than about 70% yield based on **1**.

39. The method of claim 24 or 25, wherein said glycosylated product is produced in greater than about 80% yield based on **1**.

40. The method of claim 24 or 25, wherein said glycosylated product is produced in greater than about 90% yield based on **1**.

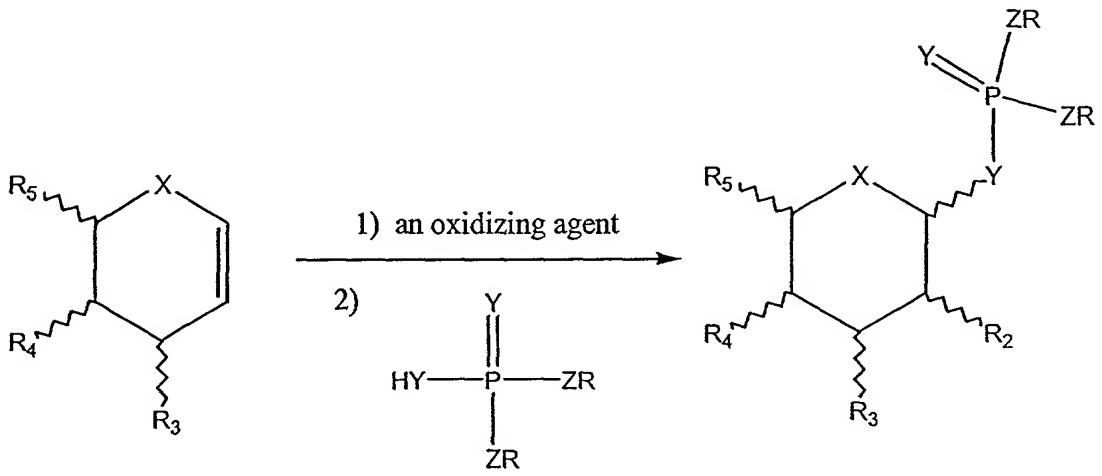
41. A combinatorial method of synthesizing libraries of oligosaccharides, comprising the steps of:

dividing a sample of substrate into a plurality of portions;

reacting each portion of substrate with a single glycosyl donor; wherein not all portions of substrate are reacted with the same glycosyl donor, and the glycosyl donors are selected from the set consisting of glycals, glycosyl halides, compounds of claim 1, anhydrosugars, *N*-pentenyl glycosides, glycosyl sulfides, glycosyl sulfoxides, trichloroacetimidates, glycosyl sulfates, and glycosyl carboxylates; and

purifying and combining the products of the previous step.

42. A method of synthesizing a compound represented by 1, wherein said method is represented by the following scheme:



1

wherein

X represents O, NR', or S;

Y represents independently for each occurrence O, NR', or S;

Z represents independently for each occurrence O, NR', or S;

the oxidizing agent is selected from the group consisting or dioxiranes, percarboxylates, and persulfates;

R is selected, independently for each occurrence, from the group consisting of H, alkyl, heteroalkyl, aryl, aralkyl, heteroaryl, and heteroaralkyl;

R' is selected, independently for each occurrence, from the group consisting of H, alkyl, heteroalkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, acyl, and sulfonyl;

R_2 is OR';

R_3, and R_4 are independently selected from the group consisting of R, -OR', -SR', -NR'$_2$, -OSO_3H, -OPO_3H_2;

R_5 is selected from the group consisting of R, -$(CR_2)_nOR'$, -$(CR_2)_nSR'$, and -$(CR_2)_nNR'_2$; and

n is an integer selected from the range 0 to 10 inclusive.

43. The method of claim 42, wherein the oxidizing agent is a dioxirane.

44. The method of claim 43, wherein the oxidizing agent is dimethyl dioxirane (DMDO).